INLET PORT FOR A CONTAINER MADE OF GEOTEXTILES

FIELD OF THE INVENTION

The invention relates to inlet ports for use with geotextile containers.

BACKGROUND OF THE INVENTION

Geotextile containers, such as disclosed in U.S. Patent No. 6,186,701, the entirety of which is herein incorporated by this reference, are known. Such containers are generally elongate in shape and formed of a strong, flexible, liquid permeable material, such as polypropylene. In use, a sludge comprising both solid and liquid materials is fed through a port sleeve into the geotextile container, which functions as a filter. The liquid from the sludge permeates the geotextile container, while the geotextile container retains the solid material (a process called "dewatering"). The liquid may then be recycled and the solid material may be destroyed or reused for other purposes.

These containers are used in a variety of applications, such as waste, mining and mineral processing, and pulp and paper processing. For example, in animal waste processing, waste sludge is fed into the geotextile container and dewatered. The liquid exiting the geotextile container may be collected and, in many cases, is clear and safe to use in other applications or to discharge into streams and rivers. Moreover, the solid waste now trapped in the geotextile container may digest and may be easily accessed for use as fertilizer or other nutrients or may be recycled. A similar dewatering process may be used to contain and capture undesirable by-products from the pulp and paper manufacturing process. Sludge residue from the manufacturing process is fed into the geotextile container, where the solid residue will

remain. The residue can then be burned or disposed in a landfill relatively inexpensively.

The integrity of the geotextile container is obviously crucial. If the container ruptures or its integrity is at all compromised, undesirable and potentially hazardous material may be introduced into the environment. Thus, the containers are generally made of a material having sufficient tensile strength and wear resistance to withstand the pressure exerted by the sludge. While the material itself is generally durable, the seams where adjacent pieces of material are joined can be less reliable. The seams are subject to extreme tensile stress and thus, if a rupture is to occur, it typically does so at the seams.

Geotextile containers generally have a port sleeve for filling the container with sludge. The port sleeve is typically made from the same material as the rest of the container. The sleeve is attached directly to the container by sewing one end of the sleeve to the periphery of a hole provided in the container. A hose or pipe that supplies the sludge material to the container is inserted into the port sleeve and the port sleeve may be cinched around the hose or pipe. During the filling process, the hose or pipe often moves and thus stretches and pulls on the port sleeve. Eventually the seam joining the port sleeve to the container may succumb to such stresses and fail.

Accordingly a geotextile container is needed having increased integrity at the port sleeve attachment area to minimize the likelihood of rupture.

SUMMARY OF THE INVENTION

As explained above, geotextile container port sleeves traditionally have been sewn directly to the container. If the container ruptures, it usually begins at the seam between the port sleeve and the container. This invention is directed to a geotextile container having strengthened port sleeve attachments. The integrity of the port sleeve of this invention is strengthened by incorporating an inlet port, having a port patch and a port sleeve, into a geotextile container. The inlet port is preferably made of a pliable material which renders attachment of the inlet port to the geotextile container easier and results in tighter, stronger seams between the inlet port and the geotextile container. With its stronger material and the resulting tighter seams, the inlet port and port patch are better able to withstand stresses and seams are less likely to rupture, thereby enhancing the integrity of the geotextile container.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a partial perspective view of one embodiment of an inlet port attached to a geotextile container.

FIG. 2a is a partial perspective view of an embodiment of a seam that may be used to attach an inlet port to a geotextile container.

FIG. 2b is a partial perspective view of an alternative embodiment of a seam that may be used to attach an inlet port to a geotextile container.

FIG. 2c is a partial perspective view of another alternative embodiment of a seam that may be used to attach an inlet port to a geotextile container.

FIG. 2d is a partial perspective view of yet another alternative embodiment of a seam that may be used to attach an inlet port to a geotextile container.

FIG. 3 is a perspective view of a geotextile container provided with an inlet port according to an embodiment of this invention.

DETAILED DESCRIPTION

FIG. 1 illustrates one embodiment of an inlet port 10 attached to a geotextile container 12. The inlet port 10 includes a port patch 14 and a port sleeve 16. The inlet port 10 is preferably, but does not have to be, made from a material that is stronger and more pliable than the polypropylene material from which geotextile containers 12 are typically made. Any textile material, including, but not limited to, nylon and polyester, may be used to construct the inlet port 10. Polyester is particularly well-suited to this application. While the port patch 14 and the port sleeve 16 may be integrally-formed from a single piece of fabric, they may also be provided as separate components that are attached together, as shown in FIG. 1. If so, the port patch 14 and port sleeve 16 need not be constructed from the same material. However, given the benefits of polyester or other similar woven textiles, it is preferable, but not mandatory, that both the port patch 14 and port sleeve 16 be made of polyester. The increased pliability of polyester renders attachment of the port sleeve 16 to the port patch 14 and the inlet port 10 to geotextile container 12 easier and results in tighter, stronger seams 19, 26 between port patch 14 and port sleeve 16 and between inlet port 10 and geotextile container 12, respectively. With its stronger material and the resulting tighter seams, inlet port 10 is better able to withstand stresses and seams 19, 26 are less likely to rupture. While the entire geotextile container 12 can be made from a polyester material, manufacturing costs associated

with geotextile containers may be minimized by constructing only the inlet port 10, which is generally subjected to the most stress, with this more durable fabric.

Manufacture of one embodiment of the geotextile container 12 of this invention requires (1) assembly of the inlet port 10 (assuming that the port sleeve and port patch are not integrally-formed) and (2) securing the inlet port 10 to the geotextile container 12.

To create the inlet port 10, a panel of fabric is first cut to form the port patch 14. A hole (not shown), to which the port sleeve 16 will attach and through which material will flow into container 12, is provided in port patch 14. The size and shape of the hole will generally depend on, among other things, the size and shape of the port sleeve 16 and the amount of material required to secure the port sleeve 16 to the port patch 14 with the desired seam 19 and attachments means, such as stitching 17.

The size and shape of the port sleeve 16 will generally depend on the size and shape of the pipe or hose 18 supplying material to container 12 through the port sleeve 16 (see FIG. 1). While the port sleeve 16 may be formed in any shape that will receive a pipe or hose 18, a substantially cylindrical-shaped port sleeve 16 will be suitable in most applications. Moreover, a port sleeve 16 having an eight (8) to twenty-four (24) inch diameter (and preferably an eighteen (18) inch diameter) will generally accommodate most pipe or hoses and be suitable in most applications. Given the pliable nature of the inlet port 10 material, the port sleeve 16 can easily be cinched with a drawstring 22 (as shown in FIG. 1) to accommodate smaller pipes or hoses 18 without jeopardizing the integrity of, but rather ensuring that a tight seal is formed between, the pipe or hose 18 and port sleeve 16.

The inlet port 10 may be assembled by placing the port sleeve 16 over (or, alternatively, into) the hole in the port patch 14 and attaching it to the periphery of the hole using any attachment means that will ensure a bond with the strength necessary to withstand the pressures exerted on the port sleeve 16 and the port patch 14, especially during filling. The port sleeve 16 may be attached to the port patch 14 by any suitable method, including, but not limited to, sewing, heat seaming, ultrasonic welding or gluing. Sewing the port sleeve 16 to port patch 14 at seam 19 with stitching 17, as shown in FIG. 1, has proven highly effective.

The inlet port 10 (in particular, the port patch 14) may then be attached to the container 12. One of skill in the art will understand, however, that the port sleeve 16 may be attached to the port patch 14 after the port patch 14 has been attached to the container 12.

The inlet port 10 may be integrated into the container 12 after the container 12 is formed. For example, the container could be formed leaving a hole shaped to receive and attach with the port patch 14. Alternatively, the container could be formed and then a portion of the container removed to receive the port patch 14.

Economies of manufacture may be achieved, however, by integrating attachment of the port patch 14 with the formation of the container 12. For example, geotextile containers are often formed by attaching adjacent side edges of container panels 42, 44 at side seam 60 and then mating the end edges of the panels at longitudinal seams 34, 36 to form a geotextile container. The size and number of the container panels will obviously depend on the desired capacity of the container 12.

Moreover, each container panel may be formed of multiple pieces of fabric secured together to form a single panel.

The inlet port 10 may be integrated into container 12 manufacture by integrating the port patch 14 into a container panel and then attaching the container panels together to form container 12. FIG. 3 illustrates a container 12 formed of three container panels 40, 42, 44. The container panels 42, 44 are joined at side seam 60 and longitudinal seams 34, 36. The inlet port 10 is shown integrated into container panel 40, which is attached to panel 42 at side seam 62. The port patch 14 may be of any size and shape to mate with the edges of panel 40. Generally, the port patch 14 should be sized so that, when the port patch 14 is positioned between the end edges of panel 40, the edges of the port patch material overlap with the container material by an amount sufficient to create the desired longitudinal seam 26 between the port patch 14 and the end edges of panel 40. An overlap of at least six (6) inches has been found preferable, although not necessary. This overlap aids in preventing the port patch 14 from detaching from the edges of panel 40 when subjected to stress. While a rectilinear-shaped port patch 14 may prove the easiest to attach, any shaped port patch 14 may be used as long as it mates with the edges of panel 40 to form an integrated container panel.

Although not necessary, a port patch 14 of the same length (measured in the direction of longitudinal seam 26) as panel 40 is particularly suitable, as it may minimize the number of seams on the container 12. To manufacture a container having a sixty (60) foot circumference, a container panel 40 having a width of fifty (50) feet may be joined with an inlet port having a width of ten (10) feet. In another

embodiment (not shown), the panel 40 may be formed of two sections each having a width of twenty-five (25) feet. One of skill in the art will readily understand that the dimensions of any of the container panels or port patches may be varied depending on the application. Furthermore, the inlet port 10 may be positioned anywhere on the container 12, and any number of additional container panels or port patches may be added to the container 12 depending on the desired length and capacity of the container 12.

The port patch 14 and panel 40 may be attached by any method that will ensure a bond between port patch 14 and the container 12 that can withstand the pressure exerted at seam 26, particularly during filling. The port patch 14 may be attached to the container 12 by heat seaming, gluing, ultrasonic welding or the like, but sewing has proven highly effective.

When the desired number of container panels have been joined together, the end panels of the container 12 (in this case, panels 40 and 44) may be closed off to enclose the geotextile container 12 and thereby allow the container to contain materials fed into it via inlet port 10. For example, in FIG. 3, the edges 70, 72 of end panel 40 and the edges 74, 76 of end panel 44 may be secured together (such as by, for example, sewing, heat seaming, gluing, ultrasonic welding, etc.) to enclose container 12.

As explained above, any suitable attachment means (for example, heat seaming, gluing, ultrasonic welding, etc.) may be used to secure the port sleeve 16 to the port patch 14 and the port patch 14 to the container 12. Sewing the component parts together will generally result in bonds between the port sleeve 16 and port patch

14 and between the container 12 and port patch 14 with the strength necessary to withstand the pressures exerted on the inlet port 10, especially during filling. For example, FIGS. 1 and 3 show the port patch 14 sewn to the port sleeve 16 and to the container 12 at seams 19, 26 with stitching 17, 24, respectively. The type of seam chosen may depend on, among other considerations, the particular use of the container 12 and the foreseeable stresses to which the container 12, and particularly the inlet port 10, may be subjected. The strength of the resulting seams 19, 26 between the port sleeve 16 and the port patch 14 and between the container 12 and port patch 14, respectively, can be impacted by a number of factors, including the type of seam, the type of stitch, the type of thread, and the stitch density.

FIGS. 2A-D illustrate examples of the types of seams that may be used in the manufacture of the geotextile container 12 of this invention. A "flat" or "prayer" seam 32, shown in FIG. 2A, is formed by placing together the facing edges of two textiles, for example, the facing edges of the port patch 14 and the geotextile container 12. A "butterfly" seam 28 (FIG. 2B) is formed by placing together the facing edges of two textiles and then folding a portion of each textile back onto itself. This creates four layers of textile that can then be secured together. A "J" seam 30 (FIG. 2C) is formed by placing together the facing edges of two textiles and then folding a portion of both onto one of the textiles. The "J" seam 30 and "butterfly" seam 28, while generally more difficult to form than a prayer seam, are preferable in applications where stronger seams are necessary. An "overlap" seam 38 (FIG. 2D) is formed by overlapping the edges of two adjacent textiles and securing them together in the area of overlap. One of skill in the art will understand that these seams, among

others, may also be used to secure the port sleeve 16 to the port patch 14, assuming the inlet port 10 is not integrally-formed.

While any type of seam suitable to sew geotextile fabrics is suitable, the prayer and "J" seams have been found particularly effective in securing the port sleeve 16 to the port patch 14 and the overlap and "J" seams have been found particularly effective for attaching the port patch 14 to the container 12.

Any type of suitable stitching 17, 24 that imparts sufficient strength to seams 19, 26 may be used. A double-thread lockstitch has been found to be particularly effective. Moreover, any thread that will provide sufficient seam strength may be used with this invention. For example, Kevlar, nylon, polyester or polypropylene threads, among others, are all suitable. The ply and denier of the thread used may vary depending on the thread material and the seam strength desired. One thousand (1000) denier polyester thread has been found to be effective for stitching both the port sleeve 16 to the port patch 14 and the port patch 14 to the container 12. In particular, nine (9) ply thread may be used in the looper, while twelve (12) ply thread is used in the needle.

Any stitch density suitable to the particular material, thread and seam strength desired may be used as one with skill in the art will readily surmise. Stitches that are too close and/or thread tensions that are too tight tend to cut the geotextile material. Stitch densities of at least 4 to 5 stitches per inch have been found sufficient to impart the necessary strength to the seam. However, higher stitch densities may be desirable for use with geotextiles having heavier, tighter base yarns and lower stitch densities may be desirable for use with lighter geotextiles.

A geotextile container may be provided with a plurality of inlet ports 10 distributed along its length. During a filling operation, all, some, or only one of the inlet ports 10 may be used. Some of the inlet ports 10 may be selectively closed or may serve as overpressure or over-flow valves. After filling, the inlet ports 10 may be tied off with drawstring 22 or other suitable means to close the geotextile container 12 and secure the filling material within the container 12.

The particular embodiments of the invention illustrated and described above are not limiting of the present invention, and those of skill in the art can readily determine that additional embodiments and features of the invention are within the scope of the appended claims and equivalents thereto.